Atmospheric Forcing and Its Spatial Variability Over the Japan Sea

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LONG-TERM GOALS

The long-term goal of this project is to improve our understanding of the marine atmospheric boundary layer (MABL), its spatial structure and variability, and the resultant ocean surface forcing over the Japan/East Sea (JES).

OBJECTIVES

The objective of this project is to determine the structure of the MABL over the JES, understand the dynamical role of the adjacent orography in modifying the flow, and evaluate the effect of the forcing on the surface wind stress and heat flux.

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APPROACH

The approach taken in this project is to (i) make ship and fixed-point measurements to observe the spatial and temporal structure of the MABL in spring/summer (1999) and in winter (2000), with emphasis on winter cold-air outbreaks; (ii) compile and analyze JMA buoy met data, regional WMO surface and upper-air data, stationary weather satellite images, and ECMWF fields to determine the synoptic setting during undisturbed (summertime) periods and during the active winter season; and (iii) conduct a process-oriented numerical modeling study to gain dynamical understanding of the wintertime topographically-modified flow, and to compare these model flows to observations and to results from more complex models.

WORK COMPLETED

Dorman visited Vladivostok in June 1998 and made valuable contacts with Y. Volkov (FERHRI), who will oversee the Russian contribution sing the R/V Khromov, and several Russian meteorologists who plan to participate with Dorman. Based on these interactions, plus our own discussions with other U.S. PIs, especially L. Talley (SIO) and C. Lee (U. Washington), we have developed a firm plan for the field work to be conducted by this project for the 1999-2000 period. This includes obtaining a full suite of ship met measurements on all R/V Revelle JES cruises, on both the summer and winter R/V Khromov cruises, and balloon sounding measurements on several spring and winter Revelle cruises and on the Khromov winter cruise. In particular, Dorman will join the C. Lee SeaSoar cruises and use some added dedicated shiptime to make intensive soundings during the winter 2000 cruise.

Beardsley met with the SIO shipboard tech group in October 1998, who agreed to supply the Revelle with freshly calibrated IMET systems at the beginning of the ONR JES cruises in both 1999 and 2000. Both WHOI and SDSU are presently acquiring and testing the needed met equipment for the Revelle and Khromov, and are starting to interact with the Khromov crew on identifying suitable locations for sensor placements.

Rogerson attended the November PI meeting and described our overall research plan. She also started to coordinate her modeling ideas with S. Chen (U. Miami), who is beginning to use the MICON model to simulate the regional weather. Rogerson has started analysis of Russian sounding data collected by Chen to begin to identify model parameter values.

Dorman also plans to deploy an automated weather station in Vladivostok (roof of the FERHRI building in downtown Vladivostok) in winter 1998/99 and make observations through summer 2000.

Dorman has started to collect the following data: a) WMO surface and upper-air data from stations surrounding the JES; b) 3-hourly visual and IR images for the JES from the Japanese stationary satellite (with cooperation from Tokai University); and c) ECMWF model computations of surface heat flux and wind stress for the JES (in collaboration with S. Varlamov, FERHRI and Kyushu University). These time series will be continued through winter 2000.

RESULTS

IMPACT/APPLICATIONS

TRANSITIONS

RELATED PROJECTS

This project is part of the ONR Japan/East Sea DRI. The atmospheric measurements, compiled observational and model products, and model flow results that will be obtained will be of relevance to all of the projects in the DRI.

In particular, we hope to combine the ship and fixed-point JES MABL measurements with wintertime aircraft observations to be conducted by C. Friehe (UC-Irvine), drifter wind and pressure measurements to be made by P. Niller (SIO), and other data to describe specific cold air outbreaks and their effects on the surface oceanic forcing fields.

The direct observations of the MABL will be utilized by Chen for assimilation and validation in a 3-D meso-scale atmospheric model. Results from the idealized modeling investigation will be compared with these 3-D model simulations, with emphasis on understanding the dynamics of the topographically-modified flow.

REFERENCES

PUBLICATIONS